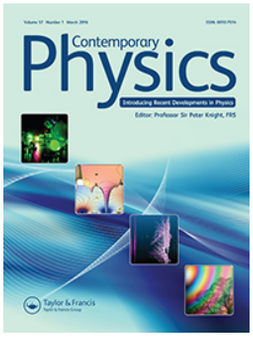

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BOOK REVIEW

Quantum optics and nanophotonics: lecture notes of the Les Houches Summer School, edited by Claude Fabre, Vahid Sandoghdar, Nicolas Treps, and Leticia F. Cugliandolo, Oxford, Oxford University Press, 2017, 464 pp., £40 (hardback), ISBN 9780198768609. Scope: edited book. Level: postgraduate, researcher.

This book contains the material of the CI Session of the *Ecole de Physique des Houches* which was held 5–30 August 2013. This prestigious school started in 1951 with courses on Quantum Mechanics and Quantum Field Theories and used to publish always the lectures in an extensive form, which is a very commendable procedure unfortunately not followed by many other good schools around the world.

In 2013, three sessions were held and this book contains the lectures of one of the three sessions, under the generic title of Quantum Optics and Nanophotonics. The treated arguments were nine, all of great interest and actuality and spanned a large area of interest. They were:

(1) Introduction to quantum information by S M Barnett. In this contribution of 58 pages, a field leader in the subject gives a short history of the field and discusses quantum communications and quantum computation. It is a very readable piece which gives a good insight.
(2) An introduction to near field optics and plasmonics by J J Greffet. Here, the basics of near-field optics are given, discussing also the computational methods, using the Green tensor. Near field optics is dominated by evanescent waves and their management may allow breaking the diffraction limit. The calculation of the local density of states of the evanescent waves is also important for the control of spontaneous emission. The final part of this contribution is a good introduction to surface plasmons. The paper of 80 pages is like a short book.
(3) Transformation optics by U Leonhardt. This short (21 pages) lecture by the leader of this new field shows how the ideas from Einstein's general relativity theory are applied to engineer a dielectric material so as to allow solutions of Maxwell equations with very special properties such as partial invisibility cloaking or perfect imaging.
(4) Temporal and spectral properties of quantum light by B Stiller, U Seyfarth and G Leuchs, in which the temporal and spectral properties of classical light are first discussed. The quantum optics of single and several modes are then considered in a contribution of 56 pages.
(5) Quantum optics with nitrogen vacancies centres in diamond by Y Chu and M D Lukin. In the 39 pages of the lecture the centres are fully described and their applications in a number of quantum experiments, such as entanglement between an optical photon and a solid-state spin qubit, laser cooling and nanophotonic devices for quantum optics, are discussed.
(6) Single-molecule spectroscopy by M Orrit (41 pp). This lecture gives an overview of the main optical methods to detect and study single molecules and other nano-objects. Fluorescence is the main method used in various conditions. A review of the main techniques used to detect individual nano-objects through their effect on a probing laser beam is then given.
(7) Quantum measurements: a modern view for quantum optics experiments by A M Steinberg.
(8) Quantum optics and cavity QED with quantum dots in photonic crystals by J Vuckovic. This lecture deals with quantum optics with semiconductor quantum dots embedded in photonic crystal cavities making a brief introduction to photonic crystals, quantum dots and quantum electrodynamics effects and showing some applications. 39 pages.
(9) Casimir forces and vacuum energy by S Reynaud and A Lambrecht that discusses the origin of Casimir force in 46 pages.

All lectures are given by leading people in the field and are provided with an ample bibliography. I have given the number of pages of each lecture to make it clear that every argument has been treated with sufficient length so as to give a good insight of the subject.

In summary, this is a precious collection of lectures on advanced and actual topics which can be of great help to both students and researchers. The typographical presentation is excellent.

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